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METHODS AND SYSTEMS FOR HIGH SPEED QUANTIZERS

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CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application No. 09/949,810, filed September 12, 2001 and entitled "Methods and Systems for High Speed Quantizers," which claims priority to U.S. Provisional Application No. 60/232,174, filed September 11, 2000 and entitled "Multi-bit Analog Delta-Sigma Modulator," each of which are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The invention relates to data converters and, more particularly, to analog-to-digital data converters, multi-bit analog delta-sigma modulators, and feedback processing.

Background

[0003] Conventional delta-sigma modulators include single bit delta-sigma modulators, multi-bit delta-sigma modulators, continuous time delta-sigma modulators, and discrete-time delta-sigma modulators. Conventional delta-sigma modulators often utilize quantizers and analog and/or digital feedback. A common example of a function implemented in digital feedback circuitry of a multi-bit analog delta-sigma modulator is dynamic element mismatch shaping.

[0004] A common problem in the implementation of delta-sigma modulators, such as multi-bit analog delta-sigma modulators, is delay in quantizer and feedback circuitry. Conventional quantizers and feedback loops operate at the same throughput rate as a main path of the delta-sigma modulator. As a result, each process performed by a quantizer and/or feedback loop adds delay to the